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Thirty-ninth Annual Report of the Savilian Professor of Astronomy to the Visitors of the University Observatory for 1913–14.

BOARD OF VISITORS, 1914.

THE VICE-CHANCELLOR (Thomas Banks Strong, D.D., Dean of Christ Church).
THE SENIOR PROCTOR (Alfred J. Jenkinson, M.A., Fellow of Brasenose).
THE JUNIOR PROCTOR (Rev. E. A. Burroughs, M.A., Fellow of Hertford).
THE ASTRONOMER ROYAL (Frank Watson Dyson, M.A., LL.D., F.R.S.).
THE DIRECTOR OF THE CAMBRIDGE OBSERVATORY (Professor A. S. Eddington, M.A., M.Sc.).
THE RADCLIFFE OBSERVER (A. A. Rambaut, M.A., D.Sc., F.R.S.).

EDWIN B. ELLIOTT, M.A., F.R.S., Fellow of Magdalen. CHARLES LEUDESDORF, M.A., Fellow of Pembroke.	For ten years until Nov. 10, 1915.
WILLIAM ESSON, M.A., F.R.S., Fellow of New College. SIR W. H. M. CHRISTIE, K.C.B., Hon. D.Sc., F.R.S.	For ten years until Nov. 10, 1920.

DURING the past year the Board has lost by death Sir R. S. Ball, Lowndean Professor of Astronomy and Geometry at Cambridge, who was a member of the Board, *ex officio*, as Director of the Cambridge Observatory. He is succeeded, *ex officio*, by Prof. A. S. Eddington, Plumian Professor of Astronomy and Experimental Philosophy, who has recently been appointed Director of the Cambridge Observatory.

The Report here presented refers to the period from April 11, 1913, to April 25, 1914, and exhibits the state of the Observatory on the last-named day.

A Committee of the Delegates of the University Museum has recently (Oct. 25, 1913) presented a report on the form and contents of Departmental Reports which are forwarded to Convocation, suggesting (1) limitations of length to 8,000 words, (2) a uniform plan of presentation.

The University Observatory is not included in the Museum Departments; but in the interests of uniformity, attention will be hereafter paid to these recommendations if they find favour with other Departments.

No change seems to be required under head (1), seeing that the Reports of the Observatory have, during the last ten years, averaged under 4,000 words, and have only once (1905-6) exceeded 6,000. But the order of presentation of headings, though it is nearly the inverse of that hitherto adopted, will hereafter be as recommended, viz. Staff, Teaching, Research and Publications, Buildings, Laboratory Equipment, Library, &c., (Collections), except that the last item disappears from our Reports. In place of it some miscellaneous matters are mentioned at the end.

I. Staff.

First Assistant. Mr. F. A. Bellamy, Hon. M.A., who has general charge of the work under the Director and represents the Director in his absence. Mr. Bellamy's service dates from 1892.

Second Assistant. Mr. R. S. Capon, B.A., St. John's, has been provisionally appointed Second Assistant for one year (to July 31, 1914), in succession to Mr. H. C. Plummer, now Royal Astronomer of Ireland.

Assistant. Miss E. F. Bellamy was formally appointed Assistant in 1912. Her work at the Observatory dates from 1899.

Caretaker. Mr. J. Mullis, whose service dates from 1876.

Computer. Mr. S. Ingles (New College Choir School), from 1913.

II. Teaching.

The course of Lectures by the Professor on the Astronomy required for the Mathematical Final Schools was delivered as usual in the Michaelmas and Hilary Terms. Three lectures were also delivered by him to Engineering Students in June, at the request of Professor Jenkin.

Mr. R. S. Capon, Second Assistant, has given practical instruction to those wishing to use the transit circle, sextant, &c.; and also one or two lectures on optics, &c.

Several parties of workers from the Oxford Summer School were shown the Observatory, and given brief lectures illustrated by lantern slides.

III. Research and Publications.

The discussion of the Cambridge magnitude equation, described in the last report, was printed as Part I of Vol. VIII, and is now being distributed.

The reduction of the photographs of composite plates (several regions overlapping), for which the above investigation was found to be a necessary preliminary, has accordingly now been resumed. Mr. Bellamy has been successful in obtaining three plates which together cover 12 hours of R.A. (zone 29°), and hopes to improve the rather more fragmentary character of the remaining 12 hours.

The reduction of the Vatican plates is proceeding steadily and the printing of zone +64° is printed to R.A. $18^h\ 36^m$. The reductions of zones +64°, +63° are complete, and zone +62° is complete as far as $18^h\ 40^m$. The general superintendence of this work has been in the hands of Miss Bellamy, who has been successful in eliminating a number of errors of various kinds.

Much of the work of the past year has, however, lain in other directions.

1. The suggestion of the periodogram method by Prof. A. Schuster some ten years ago led to the reduction of various series of observations, especially of rainfall, at this Observatory as opportunity offered, the expenses being defrayed partly by the Government Grant Fund and partly by Prof. Schuster himself. About two years ago a modification of the periodogram method was made, which ultimately resolved itself into the use of a regular Fourier Sequence; and in this new form an extensive application to sunspots was undertaken and published. Finally, in November last, it was determined to abandon the idea of permanent periodicities and to look for discontinuities. The result was startling: discontinuities

declared themselves at dates easily recognized as those of the meteor returns known as Leonids: and following up the clue thus given a hypothesis was constructed as to the origin of sunspots from a special meteor swarm and of the meteor swarm itself from the collision of the Leonids with Saturn at intervals of 265 years. This hypothesis will require much work to test it completely: but there was also a very considerable amount of work leading up to its formation, numerical work of a rather tedious kind which the various members of the staff faced in a determined manner, which I gratefully acknowledge. Since the application to sunspots reached a provisional conclusion, the same method of testing for discontinuities has been applied to the meteorological problems which had long been waiting some such new light—with results which are promising, but which are not yet ripe for mention. A volume of tables specially suitable for this work has been published during the year.

2. The death of John Milne, F.R.S., in July last, left the Director (as Chairman of the Seismological Committee of the British Association) in temporary charge of the Earthquake Station at Shide, which is also the centre for some thirty or forty British Observing stations.

3. The earlier death of Mr. S. A. Saunder similarly left in his hands much work connected with the Committee on Lunar Nomenclature appointed by the International Association of Academies. A collated list of names has been published during the year, by the efficient volunteer aid of Miss M. A. Blagg.

4. Miss Blagg has also done the bulk of the work of editing two instalments of Baxendell's *Observations of Variable Stars*, which were placed in the hands of the Director for publication some few years ago.

The following papers, by members of the staff and others, have been published during the year. It may be mentioned here that these papers are collected from time to time into volumes for circulation *in Oxford* (outside Oxford they are distributed as separate papers), and that Volume IV of these papers has just been bound and is ready for distribution :—

"Note on the Possibility of Refraction by the Solar Atmosphere." (Papers of the I. U. S. R. Computing Bureau, No. VIII.) By R. S. Capon, *Mon. Not. R. A. S.*, LXXIII, p. 361 (March, 1913).

"On a Suggested Substitute for Bode's Law." By Miss M. A. Blagg, *Mon. Not. R. A. S.*, LXXIII, p. 414 (April, 1913).

"On the Harmonic Analysis of Wolf's Sun-spot Numbers, with Special Reference to Mr. Kimura's Paper." (Papers of the I. U. S. R. Computing Bureau, No. IX.) By H. H. Turner, *Mon. Not. R. A. S.*, LXXIII, p. 549 (May, 1913).

"On the Expression of Sun-spot Periodicity as a Fourier Sequence, and the General Use of a Fourier Sequence in Similar Problems." (Papers of the I. U. S. R. Computing Bureau, No. X.) By H. H. Turner, *Mon. Not. R. A. S.*, LXXIII, p. 714 (Oct. 1913).

"Further Note on the Possibility of Refraction by the Solar Atmosphere." (Papers of the I. U. S. R. Computing Bureau, No. XI.) By R. S. Capon, *Mon. Not. R. A. S.*, LXXIII, p. 732 (Oct. 1913).

"Further Remarks on the Expression of Sun-spot Periodicity as a Fourier Sequence." (Papers of the I. U. S. R. Computing Bureau, No. XII.) By H. H. Turner, *Mon. Not. R. A. S.*, LXXIV, p. 16 (Nov. 1913).

"Sixth Note on the number of Faint Stars with Large Proper Motions. Zone + 29°." By F. A. Bellamy, *Mon. Not. R. A. S.*, LXXIV, p. 26 (Nov. 1913).

"Seventh Note on the Number of Faint Stars with Large Proper Motions. Some A. G. C. Stars in zone + 25°." By R. J. Pocock, *Mon. Not. R. A. S.*, LXXIV, p. 27 (Nov. 1913).

"On a Simple Method of detecting Discontinuities in a Series of Recorded Observations, with an application to Sun-spots, suggesting that they are caused by a Meteor Swarm due to Successive Encounters of the Leonids with Saturn, which has been more than once considerably perturbed by the Leonid Swarm." (Papers of the I. U. S. R. Computing

Bureau, No. XIII.) By H. H. Turner, *Mon. Not. R. A. S.*, LXXIV, p. 82 (Dec. 1913).

"The Periodicities of Sun-spots." By H. H. Turner, *Scientia*, XV, No. XXXIII, p. 1.

"Large P.M. of Helsingfors, No. 914." By Miss E. F. Bellamy, *Astron. Nach.*, Band 195, p. 359 (No. 4674, August, 1913).

"The Nomenclature of Variable Stars." By F. A. Bellamy, *Knowledge* (Nov. 1913).

"Baxendell's Observations of Variable Stars." Paper No. 2. By H. H. Turner and Miss M. A. Blagg, *Mon. Not. R. A. S.*, LXXIII (March, 1914).

"Note on Spectroscopic Binaries and the Velocity of Light." By R. S. Capon, *Mon. Not. R. A. S.*, LXXIII (April, 1914).

IV. Buildings.

The domes are still watertight. But there is a troublesome leakage in the Lecture Room which is difficult to locate.

The erection of the new chemical laboratory necessitated a rearrangement of our gas-pipes across the park.

The woodwork of the Observatory was repainted during the year.

By arrangement with the Museum Delegates, the services of a night-watchman for the Museum and the Observatory were retained during the months July–December, 1913.

V. Equipment, Library, &c.

The telescopes are in good order.

A wireless receiving installation has been erected by Mr. R. S. Capon (with the sanction of the G. P. O.), and has given us time signals of great use and great interest. It seems possible that these signals will play an important part in the astronomy of the future.

The large induction coil lent to Prof. Townsend in 1901 has now been returned to the Observatory.

The large Simms' micrometer for measuring photographs has been lent to Mr. J. F. M^c^Neile of Wellington College, who had previously measured several plates for us with a wooden micrometer, and has already done much very useful work for us with the better one now lent him.

Shelves have been fitted by Mullis to the walls of the staircase ascending to the roof of the Lecture Room; the considerable shelf room (172 feet) thus gained has been of great value. It has been used at present to store the reserve stock of pamphlets.

By the courtesy of Bodley's Librarian a large part of the reserve stock of Vols. I to VII of the Oxford Astrographic Catalogue has been stored in the Savilian Library.

About 250 more sheets of the Astrographic Chart have been received during the year, of which 90 are of regions South of the Equator.

The formation of the card catalogue of pamphlets has proceeded steadily: as also the cutting down of the sheets of the Astrographic Chart for storage.

A number of lantern slides have been made for lecture purposes; and one or two pieces of lecture apparatus have been purchased.

VI. Miscellaneous.

Mr. A. E. Young, formerly Deputy Surveyor General of the Federated Malay States Survey Department, has been working here as a volunteer since October last.

Mr. R. J. Pocock, B.A., of Queen's, who has done research work at the Observatory during the past two years, has been appointed Director of the Nizamiah Observatory, Hyderabad, India, and left to take up his new duties in March. The Nizamiah Observatory has undertaken part of the Astrographic Catalogue (Zone -17° to -23°).

The meeting of the International Union for Solar Research, at Bonn in August last, brought a number of eminent American Astronomers to Europe, and we had the pleasure of seeing at Oxford among others Prof. Joel Stebbins from Illinois University Observatory, Prof. E. C. Pickering and Miss A. J. Cannon from Harvard, Prof. H. N. Russell from Princeton, Prof. F. Schlesinger from Allegheny, Prof. (Miss) S. F. Whiting and Miss Allen from Wellesley, Prof. J. A. Parkhurst from Yerkes, Prof. J. S. Plaskett from the Dominion Observatory, Ottawa; as well as Dr. Max Wolf of Heidelberg in February last, when he came over to receive the R. A. S. Gold Medal.

The Director attended the Bonn meeting, taking charge of some of the business in the absence, through illness, of Prof. Schuster: and is now passing the volume of Transactions through the press. He also attended the meeting of the Astronomische Gesellschaft at Hamburg, which followed closely on the Bonn meeting; and the meeting of the British Association at Birmingham, at which he was appointed one of the General Secretaries of the Association.

H. H. TURNER.

UNIVERSITY OBSERVATORY,
OXFORD,
April 25, 1914.